

### Sources of Additional Information

For information about apprenticeships or other work opportunities, contact local plastering contractors, locals of the unions previously mentioned, a local joint union-management apprenticeship committee, or the nearest office of your State apprenticeship agency or your State employment service.

For general information about the work of plasterers and stucco masons, contact:

✦ International Union of Bricklayers and Allied Craftsmen, 815 15th Street, NW., Washington, DC 20005.

✦ Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 14405 Laurel Place, Suite 300, Laurel, MD 20707.

## Plumbers, Pipefitters, and Steamfitters

(O\*NET 87502A and 87502B)

### Significant Points

- Although employment is projected to increase slowly, job opportunities should be excellent because not enough people are seeking training as plumbers, pipefitters, and steamfitters.
- Most workers learn the trade through a formal 4 to 5-year apprenticeship program.
- Plumbers, pipefitters, and steamfitters are one of the largest and highest paid construction occupations.

### Nature of the Work

Most people are familiar with plumbers who come to their home to unclog a drain or install an appliance. In addition to these activities, however, plumbers, pipefitters, and steamfitters install, maintain, and repair many different types of pipe systems. For example, some systems move water to a municipal water treatment plant and then to residential, commercial, and public buildings. Other systems dispose of waste, provide gas to stoves and furnaces, or supply air-conditioning. Pipe systems in power plants carry the steam that powers huge turbines. Pipes also are used in manufacturing plants to move material through the production process.

Although plumbing, pipefitting, and steamfitting sometimes are considered a single trade, workers generally specialize in one of these

three areas. *Plumbers* install and repair the water, waste disposal, drainage, and gas systems in homes and commercial and industrial buildings. Plumbers also install plumbing fixtures—bathtubs, showers, sinks, and toilets—and appliances such as dishwashers and water heaters. *Pipefitters* install and repair both high and low-pressure pipe systems used in manufacturing, in the generation of electricity, and in heating and cooling buildings. They also install automatic controls that are increasingly being used to regulate these systems. Some pipefitters specialize in only one type of system. *Steamfitters*, for example, install pipe systems that move liquids or gases under high pressure. *Sprinklerfitters* install automatic fire sprinkler systems in buildings.

Plumbers, pipefitters, and steamfitters use many different materials and construction techniques, depending on the type of project. Residential water systems, for example, use copper, steel, and plastic pipe that can be handled and installed by one or two workers. Municipal sewerage systems, on the other hand, are made of large cast iron pipes; installation normally requires crews of pipefitters. Despite these differences, all plumbers, pipefitters, and steamfitters must be able to follow building plans or blueprints and instructions from supervisors, lay out the job, and work efficiently with the materials and tools of the trade. Increasingly, computers are used to create blueprints and plan layouts.

When construction plumbers install piping in a house, for example, they work from blueprints or drawings that show the planned location of pipes, plumbing fixtures, and appliances. They first lay out the job to fit the piping into the structure of the house with the least waste of material and within the confines of the structure. They then measure and mark areas where pipes will be installed and connected. Construction plumbers also check for obstructions such as electrical wiring and, if necessary, plan the pipe installation around the problem.

Sometimes plumbers have to cut holes in walls, ceilings, and floors of a house. For some systems, they may have to hang steel supports from ceiling joists to hold the pipe in place. To assemble a system, plumbers—using saws, pipe cutters, and pipe-bending machines—cut and bend lengths of pipe. They connect lengths of pipe with fittings with the method depending on the type of pipe used. For plastic pipe, plumbers connect the sections and fittings with adhesives. For copper pipe, they slide fittings over the end of the pipe and solder the fitting in place with a torch.

After the piping is in place in the house, plumbers install the fixtures and appliances and connect the system to the outside water or sewer lines. Finally, using pressure gauges, they check the system, to insure the plumbing works properly.

### Working Conditions

Because plumbers, pipefitters, and steamfitters frequently must lift heavy pipes, stand for long periods, and sometimes work in uncomfortable or cramped positions, they need physical strength as well as stamina. They also may have to work outdoors in inclement weather. In addition, they are subject to possible falls from ladders, cuts from sharp tools, and burns from hot pipes or soldering equipment.

Plumbers, pipefitters, and steamfitters engaged in construction generally work a standard 40-hour week; those involved in maintaining pipe systems, including those who provide maintenance services under contract, may have to work evening or weekend shifts, as well as be on call. These maintenance workers may spend quite a bit of time traveling to and from work sites.

### Employment

Plumbers and pipefitters held about 426,000 jobs in 1998. About two-thirds worked for mechanical and plumbing contractors engaged in new construction, repair, modernization, or maintenance work. Others did maintenance work for a variety of industrial, commercial, and government employers. For example, pipefitters were employed as maintenance personnel in the petroleum and chemical industries,



*Plumbers install and repair waste disposal systems in homes.*

where manufacturing operations require the moving of liquids and gases through pipes. Almost 1 of every 5 plumbers, pipefitters, and steamfitters was self-employed.

Jobs for plumbers, pipefitters, and steamfitters are distributed across the country in about the same proportion as the general population.

**Training, Other Qualifications, and Advancement**

Virtually all plumbers, pipefitters, and steamfitters undergo some type of apprenticeship training. Many programs are administered by local union-management committees made up of members of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada, and local employers who are members of either the Mechanical Contractors Association of America, Inc., the National Association of Plumbing-Heating-Cooling Contractors, or the National Fire Sprinkler Association, Inc.

Nonunion training and apprenticeship programs are administered by local chapters of the Associated Builders and Contractors, the National Association of Plumbing-Heating-Cooling Contractors, the American Fire Sprinkler Association, or the Home Builders Institute of the National Association of Home Builders.

Apprenticeships—both union and nonunion—consist of 4 to 5 years of on-the-job training, in addition to at least 144 hours annually of related classroom instruction. Classroom subjects include drafting and blueprint reading, mathematics, applied physics and chemistry, safety, and local plumbing codes and regulations. On the job, apprentices first learn basic skills such as identifying grades and types of pipe, using the tools of the trade, and safely unloading materials. As apprentices gain experience, they learn how to work with various types of pipe and how to install different piping systems and plumbing fixtures. Apprenticeship gives trainees a thorough knowledge of all aspects of the trade. Although most plumbers, pipefitters, and steamfitters are trained through apprenticeship, some still learn their skills informally on the job.

Applicants for union or nonunion apprentice jobs must be at least 18 years old and in good physical condition. Apprenticeship committees may require applicants to have a high school diploma or its equivalent. Armed Forces training in plumbing and pipefitting is considered very good preparation. In fact, persons with this background may be given credit for previous experience when entering a civilian apprenticeship program. Secondary or post secondary courses in shop, plumbing, general mathematics, drafting, blueprint reading, computers, and physics also are good preparation.

Although there are no uniform national licensing requirements, most communities require plumbers to be licensed. Licensing requirements vary from area to area, but most localities require workers to pass an examination that tests their knowledge of the trade and of local plumbing codes.

Some plumbers, pipefitters, and steamfitters may become supervisors for mechanical and plumbing contractors. Others go into business for themselves.

**Job Outlook**

Job opportunities for skilled plumbers, pipefitters, and steamfitters are expected to be excellent, as growth in demand outpaces the supply of workers trained in this craft. Employment of plumbers, pipefitters, and steamfitters is expected to grow more slowly than the average for all occupations through the year 2008. However, the pool of young workers available to enter training programs will also be increasing slowly, and many in that group are reluctant to seek training for jobs that may be strenuous and have uncomfortable working conditions.

Construction activity—residential, industrial, and commercial—is expected to grow slowly over the next decade. Demand for plumbers will stem from building renovation, including the increasing installation of sprinkler systems; repair and maintenance of existing residential systems; and maintenance activities for places having extensive systems of pipes, such as power plants, water and

wastewater treatment plants, pipelines, office buildings, and factories. However, the growing use of plastic pipe and fittings, which are much easier to install and repair than other types; increasingly efficient sprinkler systems; and other new technologies will mean employment will not grow as fast as it has in past years. However, several thousand positions will become available each year from the need to replace experienced workers who retire or leave the occupation for other reasons.

Traditionally, many organizations with extensive pipe systems have employed their own plumbers, pipefitters, or steamfitters to maintain the equipment and keep everything running smoothly. But, to reduce labor costs, many of these firms no longer employ a full-time in-house plumber or pipefitter. Instead, when they need a plumber, they rely on workers provided under service contracts by plumbing and pipefitting contractors.

Construction projects provide only temporary employment so when a project ends, plumbers, pipefitters, and steamfitters working on the project may experience bouts of unemployment. Because construction activity varies from area to area, job openings, as well as apprenticeship opportunities, fluctuate with local economic conditions. However, employment of plumbers, pipefitters, and steamfitters is generally less sensitive to changes in economic conditions than some of the other construction trades. Even when construction activity declines, maintenance, rehabilitation, and replacement of existing piping systems, as well as the growing installation of fire sprinkler systems, provide many jobs for plumbers, pipefitters, and steamfitters.

**Earnings**

In 1998, median hourly earnings of plumbers, pipefitters, and steamfitters were \$16.67. The middle 50 percent earned between \$12.81 and \$22.18. The lowest 10 percent earned less than \$10.16 and the highest 10 percent earned more than \$30.99. Median hourly earnings in the industries employing the largest numbers of plumbers, pipefitters, and steamfitters in 1997 are shown below:

Motor vehicles and equipment .....	\$21.70
Plumbing, heating, and air conditioning .....	16.10
Heavy construction, except highway .....	15.60
Nonresidential building construction .....	15.20
Local government, except education and hospitals .....	14.00

Apprentices usually begin at about 50 percent of the wage rate paid to experienced plumbers, pipefitters, and steamfitters. Wages increase periodically as skills improve. After an initial waiting period, apprentices receive the same benefits as experienced plumbers, pipefitters, and steamfitters.

Many plumbers, pipefitters, and steamfitters are members of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada.

**Related Occupations**

Other occupations in which workers install and repair mechanical systems in buildings are boilermakers; stationary engineers; electricians; elevator installers and repairers; industrial machinery repairers; millwrights; sheet-metal workers and duct installers; and heating, air-conditioning, and refrigeration mechanics and installers.

**Sources of Additional Information**

For information about apprenticeships or work opportunities in plumbing, pipefitting, and steamfitting, contact local plumbing, heating, and air-conditioning contractors; a local or State chapter of the National Association of Plumbing, Heating, and Cooling Contractors; a local chapter of the Mechanical Contractors Association; a local chapter of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada; or the

nearest office of your State employment service or State apprenticeship agency. This information is also available from:

☛ The Home Builders Institute, National Association of Home Builders, 1201 15th St. NW., Washington, DC 20005.

For general information about the work of plumbers, pipefitters, and sprinklerfitters, contact:

☛ National Association of Plumbing-Heating-Cooling Contractors, 180 S. Washington St., P.O. Box 6808, Falls Church, VA 22040.

☛ Associated Builders and Contractors, 1300 North 17th St., Rosslyn, VA 22209.

☛ National Fire Sprinkler Association, Robin Hill Corporate Park, Rt. 22, Box 1000, Patterson, NY 12563.

☛ American Fire Sprinkler Association, Inc., 12959 Jupiter Rd., Suite 142, Dallas, TX 75238-3200.

☛ Mechanical Contractors Association of America, 1385 Piccard Dr., Rockville, MD 20850.

## Roofers

(O\*NET 87808)

### Significant Points

- Jobs for roofers should be plentiful through the year 2008, because roofing work is hot, strenuous, and dirty, making job turnover high.
- Demand for roofers is less susceptible to downturns in the economy than some of the other construction trades because the majority of roofing work is repair and reroofing.
- Roofing has the highest accident rate of all construction occupations.

### Nature of the Work

A leaky roof can damage ceilings, walls, and furnishings. To protect buildings and their contents from water damage, roofers repair and install roofs made of tar or asphalt and gravel; rubber or thermoplastic; metal; or shingles made of asphalt, slate, fiberglass, wood, tile, or other material. Repair and reroofing—replacing old roofs on existing buildings—provide many job opportunities for these workers. Roofers also may waterproof foundation walls and floors.

There are two types of roofs, flat and pitched (sloped). Most commercial, industrial, and apartment buildings have flat or slightly sloped

ing roofs. Most houses have pitched roofs. Some roofers work on both types; others specialize.

Most flat roofs are covered with several layers of materials. Roofers first put a layer of insulation on the roof deck. Over the insulation, they then spread a coat of molten bitumen, a tar-like substance. Next, they install partially overlapping layers of roofing felt—a fabric saturated in bitumen—over the insulation surface. Roofers use a mop to spread hot bitumen over the surface and under the next layer. This seals the seams and makes the surface watertight. Roofers repeat these steps to build up the desired number of layers, called “plies.” The top layer is either glazed to make a smooth finish or has gravel embedded in the hot bitumen for a rough surface.

An increasing number of flat roofs are covered with a single-ply membrane of waterproof rubber or thermoplastic compounds. Roofers roll these sheets over the roof’s insulation and seal the seams. Adhesive, mechanical fasteners, or stone ballasts hold the sheets in place. The building must be of sufficient strength to hold the ballast.

Most residential roofs are covered with shingles. To apply shingles, roofers first lay, cut, and tack 3-foot strips of roofing felt lengthwise over the entire roof. Then, starting from the bottom edge, they nail overlapping rows of shingles to the roof. Workers measure and cut the felt and shingles to fit intersecting roofs and to fit around vent pipes and chimneys. Wherever two roof surfaces intersect or shingles reach a vent pipe or chimney, roofers cement or nail flashing—strips of metal or shingle over the joints to make them watertight. Finally, roofers cover exposed nailheads with roofing cement or caulking to prevent water leakage.

Some roofers also waterproof and dampproof masonry and concrete walls and floors. To prepare surfaces for waterproofing, they hammer and chisel away rough spots or remove them with a rubbing brick before applying a coat of liquid waterproofing compound. They may also paint or spray surfaces with a waterproofing material or attach waterproofing membrane to surfaces. When dampproofing, they usually spray a bitumen-based coating on interior or exterior surfaces.

### Working Conditions

Roofing work is strenuous. It involves heavy lifting, as well as climbing, bending, and kneeling. Roofers work outdoors in all types of weather, particularly when making repairs. These workers risk injuries from slips or falls from scaffolds, ladders, or roofs or from burns from hot bitumen. In addition, roofs become extremely hot during the summer. In fact, of all construction industries, the roofing industry has the highest accident rate.

### Employment

Roofers held about 158,000 jobs in 1998. Almost all wage and salary roofers worked for roofing contractors. About 1 out of every 3 roofers was self-employed. Many self-employed roofers specialize in residential work.

### Training, Other Qualifications, and Advancement

Most roofers acquire their skills informally by working as helpers for experienced roofers. They start by carrying equipment and material and erecting scaffolds and hoists. Within 2 or 3 months, trainees are taught to measure, cut, and fit roofing materials, and later, to lay asphalt or fiberglass shingles. Because some roofing materials are used infrequently, it can take several years to get experience working on all the various types of roofing applications.

Some roofers train through 3-year apprenticeship programs administered by local union-management committees representing roofing contractors and locals of the United Union of Roofers, Waterproofers, and Allied Workers. The apprenticeship program generally consists of a minimum of 2,000 hours of on-the-job training annually, plus 144 hours of classroom instruction a year in subjects such as tools and their use, arithmetic, and safety. On-the-job training for apprentices is similar to that for helpers, except the



*Roofers work outdoors in all types of weather.*